CLINICAL LECTURE

ON THE

SIGNIFICANCE OF PARALYSIS AFTER INJURIES
TO THE HEAD.*Delivered at the London Hospital.*By JONATHAN HUTCHINSON, F.R.C.S.E.,
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GENTLEMEN,—The case of the man whom you saw on Thursday in Richmond ward, and whose brain is now before us, has proved to be of unusual interest. At first sight, it appears to contradict some of the conclusions which I have ventured to state in previous lectures. The man, to whom I refer, was brought in on Tuesday evening at six o'clock. He had fallen into a ship's hold. He was bleeding from his left ear, and a small portion of brain-substance lay in the meatus. There was therefore no doubt as to his having sustained a fracture of the base of the skull, and that the fracture implicated his left petrous bone. He was carried to bed, and I did not see him till twenty hours later. At the time of my visit at two o'clock on Wednesday he was lying on his back in a stupid condition, and looked very ill. When irritated, he could move both sides of his face, his left arm, and both lower extremities, and he could feel in the integument of all these parts. All his movements were, however, made slowly and feebly; in particular I noticed that it required much irritation of his face, eyes, etc., to make him move the cheeks or shut his eyes. His right upper extremity he did not move, nor did he resent irritation to it. He had been restlessly rolling about in bed, so that the nurse, to prevent his rolling out, had secured a sheet fast across him. His pupils were rather small and of equal size.

On Thursday you were all present at the time of my visit, and we spent some time at his bedside. He was then dying, being quite insensible, with slightly stertorous breathing and irregular respiration. He died on Thursday evening, and we made a *post mortem* examination the next day. I had told you that we expected to find fracture of the left petrous bone and much damage to the left sphenoidal lobe of the brain, with probably considerable effusion of blood into the arachnoid at this part. We found all this, and more. The fracture of the petrous bone involved of course the dura mater, and it gaped so that brain-substance might easily have passed into it. The position of the fracture was more external than usual; that is, it was at the base of the petrous bone, so that it was out of the way of the channel for the portio dura (aqueductus Fallopii), and directly over the meatus externus. Thus the escape of the nerve-trunk from injury and the absence of facial paralysis were fully explained. The sphenoidal lobe of the brain on both sides was most severely damaged. The lower part of the lobe on each side was smashed, so that portions of the brain-substance adhered to the dura mater, and from this directly upwards there was a hollow caused by the contusion, into which the finger might be passed for an inch and a-half. The effects of contusion were most extensive on the left side, and here the white medullary substance external to the lateral ventricle was speckled with minute dots of blood. It was curious to note, that only the under surfaces of these lobes and not their sides had suffered. The lateral aspects of the hemispheres and their upper surfaces were uninjured. This peculiarity probably implied that the man had fallen directly downwards, striking the top of his head, and thus bruising, by contre-coup, the most prominent lobe on each side of the base. Had the blow been received on one side of the vertex, then one sphenoidal lobe would have suffered more than the other, and on its side as well as its under surface. However, the chief fact for us to keep in mind, as we go on is, that each sphenoidal lobe was smashed in its interior as well as its under surface, and that the left was the more deeply damaged. There was a considerable quantity of blood-clot in the arachnoid cavity on both sides; it was spread out over the hemispheres. There was also a little blood in the tissue of the pia mater at various parts, and on the right side a small clot between the dura mater and bone, low down in the middle fossa. The central parts of the brain, the lateral ventricles and adjacent structures, showed no signs of damage.

You will recollect that the right upper extremity was paralysed; and from what I have previously said you will be prepared to hear that I account for that by the damage done to the left sphenoidal lobe. Here I must mention the part of the man's history which is exceptional to what I should have expected. The paralysis had not been there from the first. We have the testimony of Mr. Tay and the dressers that, when the man was first brought in, he could be roused, that he appeared

excited as if from drinking, that he declined with an oath to put out his tongue, and said that it did not matter to them about his tongue; and lastly, what is the most important, that he resisted forcibly with both upper extremities. It was not noticed that one arm was stronger than the other, and it was quite certain that he could use both with some vigour.

Now, in the fact that the man retained for a short time a sort of drunken consciousness, and was able to speak in answer to questions, I do not think there is anything contradictory to former experience. The anterior lobes are of much more importance in respect to consciousness and volition than the middle ones, and they were uninjured. I should, however, have expected that the man would have shown the symptom of paralysis of his extremities from the first and on both sides. Some will perhaps explain the supervention of paralysis of the right arm afterwards by supposing that it was due not directly to the laceration, but secondarily to the infiltration of the brain-substance with fluid from the torn part. There may be something in this, but I doubt if there is much, for I have seen many cases in which the paralysis was present from the first. Admitting that the paralysis from contusion of brain always increases for a while, my own hypothesis is, in this case, somewhat different. We must recollect that paralysis is after all a thing of degree, and more especially so when induced by surface-lesions of the brain. A limb which a man whilst conscious might be unable to use except in a very feeble manner, he might perhaps when drunk, or in a state of maniacal excitement, be able to use rather forcibly. Incompetency to accomplish a volitional movement when the impulse of volition is but slight, may be present when the state of the structures would permit of very different manifestations under widely different impulses. The cases in which I have been best able to appreciate the symptoms under discussion, have been those in which the patient was still both conscious and rational, and when a degree of paralysis may be recognised which would be lost in the turmoil of maniacal resistance.

Thus, then, I have tried to explain why it was that this man could struggle whilst in the receiving-room, and yet, a few hours after he had been in bed, was found to have paralysis of the arm. We have still to explain why no paralysis of the left arm was noted, seeing that both sphenoidal lobes were contused. Here, again, you must recollect that paralysis is always estimated relatively, and that this kind of it is always partial. When I examined the man on the second day, although we only made note of paralysis of the right arm, yet he used the other but little and feebly. Had his right been sound, and had he been conscious, probably we should have been able to discover a very decided degree of weakness in the left. It is probable, also, that his lower extremities, although not paralysed, were still weakened; for he had never stood, nor, I believe, attempted to stand. The circumstance that the lesion was so nearly equal on the two sides probably again prevented our discovering a degree of paralysis which would have been apparent had one member been sound, as a standard for contrast. It is necessary in explaining the fact of increase of symptoms, to bear in mind the effused blood; since, no doubt, within a few hours of these accidents, the quantity of extravasation often gradually increases. In this case, it is possible that the blood may have had some influence in inducing the ultimate insensibility; but I do not think that it caused the paralysis of the right arm, since it was equal in quantity on the two sides. Amongst other symptoms which indicated how severe was the damage which our patient's nervous centres had received, I ought to mention that he never spoke after his removal to bed; and that he passed his urine under him. Even in the most severe cases of mere concussion this latter symptom scarcely ever occurs.

There is yet one other aspect of this case to which I must advert, since it concerns practice. Brain-substance and blood had escaped from one ear; and, as we were thus made certain that the base was severely fractured, the question as to the propriety of trephining was never entertained. But the man might easily have sustained precisely similar lesions without the addition of these definite symptoms. See how the case would then have stood. A man who had at first been able to struggle and swear had become afterwards quite unconscious, and paralysis of one arm, which was not present at first, had become definite. A very strong suspicion of ruptured meningeal artery would have been raised, and I have little doubt that we should have felt obliged to give him the chance afforded by trephining. It is, then, important for us to clearly recognise that not only in cases of ruptured meningeal artery, but in many other lesions, there occurs an interval during which the patient is comparatively conscious before he sinks into insensibility. I have said "*comparatively* conscious", for much depends upon the degree. If a man were really able to walk and could talk rationally, and after that lapsed into coma, then you might feel almost certain that there was no great damage to brain-substance, and that the insensibility was due to rapid effusion of blood from a large artery, and that the ar-

tory was probably external to the dura mater. But if the consciousness be only sufficient to enable the man to say a word or two after much rousing, or to produce a state which might be mistaken for drunkenness, then it must go for very little. Such a state, during the first hour or two, is quite compatible with severe lacerations of brain-substance.

ACTION AND USE OF OXYGEN GAS, WHEN ADMINISTERED AS A THERAPEUTIC AGENT.

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3. The co-operation or otherwise of medicine must be regarded as of some moment in viewing the *modus operandi* of oxygen as a remedy in disease. Just as a close relationship exists between organic and inorganic polarity, so also must relative chemistry be kept in sight. Let us regard what is termed catalysis. Inorganic chemistry informs us that the presence of iodine, bromine, chlorine, and other of the more potent electro-negative series, will frequently cause or quicken oxidation by their presence, when the oxygen would otherwise be dormant or slow in action. Again, certain peroxides (already adverted to when speaking of the preparation of the gas for medicinal use), such as the peroxides of manganese, cobalt, cadmium, etc., by their simple contact in very small quantities with a salt containing oxygen, will cause that gas to be yielded with increased facility, and in much larger quantity, without themselves undergoing any permanent change. Now, far from these facts being adduced (which they have been) as evidence of the universal sufficiency of the oxygen in the atmosphere under any diseased condition whatever, and of the uselessness of artificially prepared oxygen as a remedy, it appears to me that they are capable of an inverse application. While admitting the frequent value of the foregoing electro-negative elements and their salts in promoting oxygenation within the organism, as well as in assisting oxygen gas therapeutically employed, I would suggest *pari passu* the probability of very small doses of more active oxygen, possessing a quasi-catalytic action in the lungs, or at least enabling ordinary atmospheric oxygen to be absorbed and combined, with increased energy as an immediate effect, and thus affording more or less continued benefit in lowered conditions of the animal economy, according to individual capability of sustaining the reaction induced.

With reference to co-operation or interference on the part of medicines, there is another interesting point to be named. It has been surmised that narcotics (opium especially) may act through suspending or lessening oxygenation within the organism. Now I have at present a lady under my care who has received great relief from small doses of oxygen gas. She had been taking thirty grains of opium daily for two months before I saw her, as the only relief for extreme neuralgia associated with cancer of the womb; and although the quantity was soon greatly reduced, yet from three to eight grains daily were still needful, notwithstanding the assistance rendered by the gas. Far from oxygen inhalation being rendered inert, it invariably, and in a marked degree, assisted the action of the opium, when the latter had partially soothed. It may be added that I have never found that the moderate use of opium interfered much with oxygen, when both were suitable for the patient's condition and disease; although, on the other hand, several lamentable instances have come under my notice where irreparable mischief resulted from a single dose of opium injudiciously administered by the practitioner, under fear that critical discharges suddenly produced by the gas, and really affording the only chance of cure, were too weakening. In fact, any sedatives or narcotics may be advantageously used with oxygen, provided that they be not abused by being given in unsuitable cases and in too large doses. Of alcohol (that much abused gift to man)—a stimulant or narcotic, according to dose—the same may be said. Supposing even that oxygenation may be rendered less active, or partially suspended, in the cerebro-spinal system, it still evidently remains influential over general nutrition and secretion in many cases, unless, indeed, injurious quantities of drugs or alcohol be administered.

In connection with this portion of the subject, I may here remark that a number of experiments upon rabbits with chloroform and oxygen, which I made eight years ago, led me to alter a mere idea which I had entertained and expressed two or three years previously; viz., that the use of oxygen would be advisable under accidental mischief from chloroform. In nearly every chloroform experiment, I found that the prior or simultaneous or subsequent employment of the gas tended rather to deepen the insensibility and further relax the tissues. In fine, it may be almost regarded as axiomatic, that *ceteris paribus* the artificial use of

oxygen will tend to promote a sedative effect where sedatives are judiciously exhibited, and will tend to assist suitably administered stimulants.

The action of oxygen, when administered internally by the stomach, would seem to involve the two considerations, condition of gas and idiosyncrasy of each organism, equally with its exhibition by the lungs. In fact, extreme variation in effect are very frequently met with in the case of two at least of the three which we will take as examples of the classes, neutral, ozonide, and antozonide; viz., superoxygenated water, ozonified water or oil, and peroxide of hydrogen.

1. *Superoxygenated water*, being neutral, is less liable to disagree than either of the others, if carefully apportioned to the requirements of each constitution. The gas in this form appears to be rapidly absorbed by the mucous lining of the stomach; for rarely does any return by eructation, and seldom is flatus induced; the occasional symptom of flatulence being probably indirect, or flatus already existent excited into movement. In a few persons, I have known an invariable sensation of heat and determination to the brain within ten minutes after imbibing half a tumbler of the water. Very many experience a quiet exhilaration or feeling of general tone throughout the body. In cold weather (taking a subject rather below the average vital heat), it is apt to chill and depress; in hot weather, to cool and brace up; but, even in winter, its use is found very beneficial for persons confined many successive hours in over-heated, pure-air-excluding apartments, and especially as a remedy for the thirst and dry mouth following a stimulating late dinner. These facts need little comment, when taken in connection with foregoing observations on the *modus operandi* of artificial oxygen.

2. *Ozonified water or oil*, whose sphere of usefulness is very limited in comparison with the preceding, appears to have an action allied to perchloric acid and (in a more remote degree) to nitro-hydrochloric acid and iodides. They demand almost as careful prescription for the stomach as ozone does for inhalation; and, if not cautiously adapted to the state of the stomach and lungs, will affect injuriously the latter as well as the former. The oil especially (and I am happy in being able partially to confirm the belief of the late Dr. Theophilus Thompson) is very useful, when tolerated by the stomach, in the vomica and glandular suppuration of strumous subjects—useful after the failure of cod-liver oil and other approved remedies. The double action of this oil receives significance from (a) the irritating effect of ozone in large proportion *versus* its alterative, tonic, and absorbent effect when very small doses are used—when, in fact, the really valuable nature of the element does not undergo abuse by poisoning the system with it, as with the abuse of alcohol, etc.; (b) the well known usefulness of cod-liver oil and other oils in certain perverted conditions of nutrition.

3. *Peroxide of hydrogen*, representing the so-called antozonic compounds, appears to me, after repeated trials in a variety of cases, to be quite an exceptional remedy for administration by the stomach; and, notwithstanding the facility with which it gives up its second atom of oxygen (quickly becoming neutral) when subjected to moderate heat out of the body, its therapeutic effect evidences considerable dissimilarity from that of oxygenated water. It is very apt to disagree and to cause irritation and flatulence in the intestinal canal; sometimes it seems to have no action; seldom has it a decidedly beneficial action. The association of a second atom of oxygen with the oxide of an electro-positive element, apparently causing the assumption of a polar condition opposite to the polar state of the oxygen in unstable protoxides and chlorine peroxides, presents, as yet, a knotty scientific point even in inorganic chemistry; and, since a great difference exists between the action of peroxide of hydrogen and the opposite loosely combined compounds of oxygen, as well as oxygen in solution, the question arises (a) whether the loose atom in the peroxide of hydrogen becomes neutral, or undergoes some other special combination in contact with the contents of the stomach or after absorption through the mucous membrane; or (b) whether it be, on one hand, inert under many conditions of the stomach and internal economy, and, on the other hand, slowly active, and thus irritating in some instances, useful in a few diseased states. Dr. Richardson's suggestion regarding its usefulness in some cases of diabetes may be favourably viewed. A special catalytic agency in reference to the abnormal production of sugar and its oxygen component may be suggested; but, as to most other perversions of health, this peroxide affords little satisfaction compared with other well approved methods of oxygen exhibition, and is besides very unpleasant to the taste of most patients; *ergo*, the impression is arrived at, that we can do very well without it, except in bad cases of diabetes, where it should be fairly tried.

In prescribing oxygen-gas in disease, there ought to be much more care than usually obtains, or is commonly deemed necessary. It would be obviously superfluous here to extend my remarks beyond inhalation, and the administration of oxygenated water; since the therapeutic employ-

* Concluded from page 329 of last number.